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(86) Patents cited in opposition:

DE	41 40 402 A1
DE-DS	27 37 014
US	63 08 284
US	50 41 124
US	39 65 578
US	38 10 279
WO	93 13 713

Examination application in accordance with § 44 PatG has been filed.

(54) Surgical cutting instrument

(57) A surgical cutting instrument (1) for insertion into a surgical working trocar exhibits an essentially tubular housing shank (10) which at one end, which is insertable into the trocar (2), is provided with an essentially tubular end section (12). The end section (12) exhibits at least one cutting device (14) which, viewed in the direction of axis of the housing shank (10), is situated, in the inserted state, within the circumferential contour of said shank and which, in the operating state, can be deflected arcuately transverse to the direction of axis. A control device (16) is provided at the second, user-side end with which the cutting device (14) can be brought out of the insertion state into the operating state.

Description

The invention concerns a surgical cutting instrument for insertion into a surgical working trocar.

In surgery, the problem of severing locally defined sections of tissue inside the body and on the skin from the surrounding tissue frequently exists. Especially with the removal of metastases in body organs like, for example, the liver or lung, one technique consists in freezing the metastases by means of a cryoprobe inserted through a trocar and their subsequent excision. The frozen metastases usually exhibit a spherical or elliptical shape and it is necessary to cut around these spherical or elliptically shaped tissue areas, thereby separating them from the surrounding tissue.

The task therefore of the present invention is to provide a surgical cutting instrument for insertion into a surgical working trocar, with which spatially defined, preferably spherical or elliptically shaped tissue areas, quickly and without difficulty, can be removed completely from the surrounding tissue.

This task is solved in accordance with claim 1 of the present invention in that the surgical cutting instrument exhibits an essentially tubular housing shank provided at a first end, which is insertable into the trocar, with an essentially tubular end section, that the end section exhibits at least one cutting device which, viewed in the direction of axis of the housing shank, is situated, in the insertion state, within the circumferential contour of said shank and which, in the operating state, can be deflected arcuately transverse to the direction of axis, and that at the second, user-side end a control device is provided with which the cutting device can be brought out of the insertion state into the operating state.

This development allows the cutting instrument to be inserted through the trocar into the interior of the body into the area of the tissue to be removed and, after insertion, to deflect the cutting instrument in such a way that it receives the desired curvature required to cut around the tissue to be removed. In this connection, the cutting instrument can be formed by a wire or a flexible blade.

Preferably, the cutting instrument is made of high-grade (stainless) steel, wolfram or a wolfram alloy and can be preferably heated to a temperature between 1000° C and 1500° C.

If heating of the cutting instrument occurs via a feed line in the housing shank extending to the user-side end with electrical energy, preferably from a high-frequency power source, the cutting process is facilitated on the one hand and, on the other, coagulation of the severed tissue simultaneously results.

Further advantageous refinements of the invention are indicated in the subclaims.

The invention is described in greater detailed in the following on the basis of a model referencing the drawing which shows, in :

Fig. 1 a first specific embodiment of a surgical cutting instrument in accordance with the invention and

Fig. 2 a partial view of a second specific embodiment of the invention.

Fig. 1 shows a surgical cutting instrument 1 which is inserted into a working trocar 2 positioned into a schematically represented body 3. The cutting instrument consists of a tubular hollow housing shank 10 whose outside diameter (5 to 6 mm) is proportioned to the insider diameter of the instrument bore of the trocar 2 in such manner that the cutting instrument can be inserted through the trocar into the body 3 and extracted without difficulty.

At its front end which is inserted through the trocar 2 into the body 3, the cutting instrument 1 is provided with a tubular end section 12 whose outside diameter essentially corresponds to the diameter of the housing shank 10. At its free end, the end section 12 is equipped with a tip 13 which facilitates penetration into body tissue. In the area of the end section 12, in the latter's wall, a longitudinal slot 11 is provided through which a wire disposed inside the housing shank 10 and the end section 12, which forms a cutting instrument 14, is able to emerge, outwardly, accompanied by arcuate deflection, transversely to the direction of axis of the housing shank 10.

At its free end, the wire 14 is provided with a thickening 15 which acts as a counter-bearing to support itself and the wire 14 against the inside of the tip 13. The wire 14 serving as the cutting device is connected to control transfer mechanism 20, itself likewise preferably constructed as a wire and which extends within the housing shank 10. The wire 14 serving as the cutting device and the control transfer mechanism 20 can also be constructed as a single piece.

The control transfer mechanism 20 extends in the interior of the housing shank to the external end of the body of the housing shank 10 which is connected to by a handle part 17, and is attached there to a control device 16.

After the cutting instrument 1 has been inserted with its end section 12 and the housing shank 10 through the trocar 2 into the body 3, the control transfer mechanism 20 is axially displaced within the housing shank 10 by pressing the control device 16 in the direction of the body, whereby the thickening 15 at the free end of the wire-shaped cutting device 14 bears against the support. At the same time, the wire-shaped cutting device 14 is deflected through the longitudinal slot 11 in the end section 12, projecting outward, whereby the cutting device 14 assumes an essentially semicircular or semi-elliptical shape.

By rotating the cutting instrument 1 by means of the handle part 17 around the longitudinal axis X, the cutting device 14 describes an essentially circular path around the axis X, whereby a spherical or rotation-elliptical area of body tissue is excised. By releasing the control device 16 and/or removal of the control transfer mechanism 20 from the housing shank 10 by means of the control device 16, the wire-shaped cutting device

14 is retracted into the interior of the end section 12 and brought to the bearing position, thereby no longer projecting over the circumferential contour of the housing shank, with the result that the cutting instrument can be removed without difficulty from the trocar 2 and, consequently, from the body 3.

The wire-shaped cutting device 14 can consist of high-grade (stainless) steel, a wolfram wire or a wire made from a wolfram alloy and by means of high-frequency voltage source 19, shown only in schematic form in the drawing, heated up. At the same time, the wire-shaped cutting device 14 is connected via the electrically conductive control transfer mechanism 20 to the one pole of the high-frequency voltage source, whereby the other pole of the high-frequency voltage source is connected via a neutral electrode 19 min to the body 3.

With this construction, the wire-shaped cutting device 14 can be coated with a synthetic layer, for example a layer of polytetrafluoroethylene (PTFE). This construction is especially suited if rapid and effective coagulation of tissue excised by the cutting device 14 is to occur. To this end, the HF voltage source can be set to deliver a heavily sloughing incision current, with automatically regulated power control (W).

The end section 12 can be interchangeably mounted on the housing shank 10, which enables ease of cleaning and also allows end sections with longitudinal slots 11 of varying length to be used in order, thereby, to obtain the radii R of the cutting device 14 in the deflected position. The end sections 12 are preferably constructed such that radii of 20 mm to 60 mm can be achieved. The wolfram wire or high-quality steel wire used for the cutting device 14 possesses a preferred diameter of approximately 0.3 to 0.5 mm.

Instead of end sections 12 of varying length, an end section with adjustable length or an end section with a longitudinal slot which is adjustable in length can be used to adapt to the desired direction of incision radius R can be provided.

Instead of one individual wire-shaped cutting device 14, a multiplicity of cutting devices, to each of which a longitudinal slot is allocated, can also be provided in the end section.

Figure 2 represents an alternative specific embodiment of a cutting instrument 100 in accordance with the invention in the area of its end section 112, which is insertable into the body. The end section 112 consists of a multiplicity of flexibly interconnected elements 112 min, 112 min min, 112 min min min, ... Inside these elements 112 min, 112 min min, 112 min min min, two wire-shaped control transfer mechanisms 120, 121 extend, which are guided outward through the housing shank 110 to a control device not shown.

At the same time, the control transfer wires 120, 121 are arranged in such a way that one of the wires is situated closer to the center of curvature of the end section 112 which can be deflected transversely to the housing shank axis X, while the other wire 120 is situated farther away from the center of curvature. The control transfer wires 120, 121 are attached at the free end of the end section 112, while maintaining their varying distances

to the center of curvature. Inside the end section 12, the control transfer wires 120. 121 are interspaced in the same manner.

By pulling on the wire 121 nearer the center of curvature and releasing the other wire 120, the end section 112 moves from its position in the insertion state, in which it is aligned with housing shank 120, into the laterally deflected position shown in Fig. 2 and forms an essentially semicircular cutting device which at one edge situated forward in rotational direction around the axis X min can be equipped with a cutting blade, such that a rotation of the cutting instrument 100 around the axis X min allows the excision of an essentially spherical or rotation-elliptical section of tissue.

On the side of the cutting device 114 shown in Fig. 2, at a minimal distance from the surface of the cutting device 114, a wire 115 is preferably arrayed which is attached to the tip of the end section 112 and is inserted into the housing shank 110 at the end of the end section 112 opposite the tip, where it changes over into an electrical line 118 or is connected to one such line which itself is connected to a high-frequency voltage source in the same manner as in the example of Fig. 1.

Obviously, all parts of the cutting instrument 1 are made from stainless material. For enhanced cutting characteristics, the cutting blade (not shown) in the exemplified embodiment of Fig. 2 can exhibit an undulated or serrated finish.

It is further possible to provide the end section with a bimetallic blade or construct it completely as a bimetallic blade to which a voltage is applied after insertion into the body 3, with the result that the bimetallic blade deflects in the desired manner.

The electrical contact of the bimetallic blade can, in this connection, occur, on the one hand, via an electrical feed line extending inside the tubular housing shank and, on the other, via an electrode mounted to the free end of the bimetallic blade, which comes into contact with body tissue and via the body tissue and an electrode affixed to the body 3 is connected to an electrical power source.

List of reference symbols

1 cutting instrument

2 trocar

3 body

10 housing shank

11 longitudinal slot

12 end section

13 wire tip

14 cutting device

15 thickening

16 control device

17 handle part

18 feed line

19 high-frequency voltage source

19 min neutral electrode

20 control transfer mechanism

100 cutting instrument

110 housing shank

112 end section

114 cutting device

115 wire

118 feed line

120, 121 control transfer mechanism

Claims

1. Surgical cutting instrument for insertion into a surgical working trocar, characterized in that
   - the cutting instrument (1, 100) exhibits an essentially tubular housing shank (10, 100) which at one end, which is insertable into the trocar (2), is provided with an essentially tubular end section (12, 112),
   - end section (12, 112) exhibits at least one cutting device (14, 114) which, viewed in the direction of axis of the housing shank (10, 110), is situated, in the insertion state, within the circumferential contour of said shank and which, in the operating state, can be deflected arcuately transverse to the direction of axis and
   - control device (16) are provided at the second, user-side end with which the cutting device (14, 114) can be brought out of the insertion state into the operating state.
2. Surgical cutting instrument in accordance with claim 1, characterized in that the cutting device (14) is formed by a wire.
3. Surgical cutting instrument in accordance with claim 1, characterized in that the cutting device (114) is formed by a flexible blade.
4. Surgical cutting instrument in accordance with claim 2 or 3, characterized in that the cutting device (14, 114) the cutting instrument is made of high-grade (stainless) steel, wolfram or a wolfram alloy.
5. Surgical cutting instrument in accordance with one of the preceding claims, characterized in that that the cutting device (14, 114) can be preferably heated to a temperature between 1000° C and 1500° C.
6. Surgical cutting instrument in accordance with claim 5, characterized in that the cutting device (14, 114) can be supplied with electrical energy for heating, preferably

from an automatically regulated high-frequency voltage source (19), via at least one feed line (18, 118) extending in the housing shank to the user-side end.

7. Surgical cutting instrument in accordance with one of the preceding claims, characterized in that the control transfer mechanisms (20, 120, 121) extend within the housing shank (10, 110) to shift the cutting device (14, 114) from the insertion state into the operating state.

8. Surgical cutting instrument in accordance with claim 7, characterized in that the control transfer mechanisms (20, 120, 121) exhibit a wire pull mechanism.

9. Surgical cutting instrument in accordance with one of the preceding claims, characterized in that the cutting device (14, 114) can be rotated around an axis which is parallel to the housing shank axis (X, X min).

10. Surgical cutting instrument in accordance with one of the preceding claims, characterized in that the cutting device (14, 114) can be adjusted in its length and whose radius of curvature (R, R min), consequently, can be adjusted in the operating state.

11. Surgical cutting instrument in accordance with one of the preceding claims, characterized in that the cutting device (114) exhibits a cutting blade provided with a heatable bimetal for deflection into the operating state.

12. Surgical cutting instrument in accordance with one of the preceding claims, characterized in that the cutting device (114) exhibits a cutting blade displaying an undulated or serrated blade finish.

13. Surgical cutting instrument in accordance with one of the preceding claims, characterized in that the cutting device (114) exhibits a cutting blade and that a cleaning device for automatic cleaning of the cutting blade is provided.

14. Surgical cutting instrument in accordance with claim 13, characterized in that the cleaning device exhibits a sheath-like receptacle for the cutting blade.

15. Surgical cutting instrument in accordance with one of the preceding claims, characterized in that the cutting device (114) exhibits a wire (115) extending along one cutting edge.

16. Surgical cutting instrument in accordance with claim 15, characterized in that the wire (115) is movable, preferably motor-driven, in its longitudinal direction.

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